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Development & Analysis of a Science Outreach Event for
Elementary Aged Children: Archie's Late-Night Party

An Undergraduate Honors Thesis Submitted in Partial fulfillment
of University Honors Program Requirements
University of Nebraska-Lincoln

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ABSTRACT

Science Outreach is important because it facilitates learning and an increase in interest in the sciences. This thesis outlines the development of a set of stations as part of “Archie’s Late-Night Party,” an event held in June, 2017 at Morrill Hall. The goal of the Morrill Hall event was to create multiple activities and educational stations for elementary aged children in various scientific fields. Under the guidance of Dr. Gwen Bachman, I created two stations to present at the event: “Sleep & Hibernation” and “Nocturnal Vision.” I describe the multiple factors and challenges that go into building stations that are kid-friendly and scientifically accurate. At the event, reactions from both the children and adults were analyzed. Overall, it was concluded that Science Outreach programs, such as “Archie’s Late-Night Party,” are greatly beneficial to society because of the interactions facilitated between scientists and the non-science community, hopefully sparking passions in the youth of our community.

Key Words: Science Outreach, Archie’s Late-Night Party, K-12, Hibernation, Nocturnal Vision

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INTRODUCTION

While grade schools provide a wide variety of resources to educate kindergarten through twelfth-grade (K-12) students, a large quantity of material is introduced to students in out-of-school settings. Because of this, there has been an increase in discussion between the science community and the public. Not only can scientists lead the public toward educated decisions, but public input can offer new ideas and perspectives to the scientists (Varner, 2014). Science outreach, especially when directed towards students, can stimulate learning, heighten interest, and lead to the consideration of science careers (Laursen, et al. 2007).

What is science outreach?

Science outreach can be defined as any activity in which dialogue occurs between scientists and individuals outside of the science community in which their research or a broad specific concept is discussed. These activities can include events like public lectures, popular press articles, and activities designed for children/students. The original motivation for scientific outreach was based on the motivation to fill the perceived science knowledge gaps of the public (Johnson, et al. 2014). Such events and activities may be funded by universities, professional groups, or community organizations (Laursen, et. al. 2007).

Regarding students, it is common for outreach programs to have a goal of increasing students' interests in science. For example, "The Science Days" outreach program had the goal of providing a group of fourth grade students with an experience to encourage student interest in science. The program also wanted to eliminate any negative preconceived notions about the sciences. (Flynn, 2005). In the event I took part in, "Archie's Late-Night Party," there were similar goals: increase student interest in biology and educate students on the basics of hibernation and nocturnal vision.

Why is science outreach important?

A quick literature search on the importance of science outreach reveals that scientists understand the need to communicate with the public. There are multiple reasons for this. First, much of the work of scientists is publicly funded, and the public therefore has a right to understand what this funding is being used for. When the public can be physically involved in scientific events, it helps them to understand the importance of the funding that their tax payer dollars go towards. While it is not possible for the entire public to fully understand the research principles and processes made possible by the funding, outreach events allow the public a glimpse into these fields, which is often enough for them to understand.

Scientific literacy is also critical for ensuring that our voting citizens are making informed decisions in a world that is increasingly leaning on scientific data to make important decisions. The controversy over climate change is an obvious example. Current research suggests that a polluted science-communication environment is to blame for disabled reasoning powers regarding climate change (Kahan, 2012). A smaller than expected number of Americans understand even the basic global warming mechanism. A simple solution to increasing the understanding of the importance of climate change is increasing public cognition on the topic. (Ranney & Clark, 2016). Regardless of political and/or personal motivations, an increase in public knowledge and understanding of global warming could greatly turn opinions in favor of working to slow climate change. This is only one of many examples of how science outreach can help the public form more informed opinions.

Finally, and more importantly, the future of science requires a constant stream of talented students to enter the field. An exposure to STEM (Science, Technology, Engineering and Math) at an early age has a positive impact on student's perceptions of science careers, and it keeps

them on track through the rest of the coursework needed to be prepared for such future careers (DeJarnette, 2012). Science Outreach is a great way to heighten student interests, get them excited about learning, provide a pathway to a core education in the sciences, and open their eyes to numerous future careers in the science fields (Kautz, 2018).

Not only is there a lack of K-12 STEM instructors, but there is also a lack of effort being made to grow and improve these instructors. One of America's most important, yet underrecognized, obstacles is the continuous shortage of STEM teachers. Surprisingly, a large percentage of STEM teachers (specifically at the high school level) do not have a college major in their main teaching assignment, or they do not have a full certification in that assignment. This obstacle exists because of the low incentives to change the problem (Marder, 2016). With increasing scientific and technological fields, the demand for workers trained in STEM fields is increasing exponentially. There needs to be a consistent effort to not only increase the number of STEM educators, but also to increase the quality of STEM education in order to prepare future generations.

Another aspect of science outreach that is particularly relevant to the project described in this thesis is the role of women in science. Although not a core goal for the project, it is important to note that the "Archie's Late-Night Party" display was generated by two female biologists (myself and Dr. Bachman), which provides possible different perspectives. Female scientific roles have been increasing throughout the past few years (slowly, yet surely) in various fields from medicine to zoology. But, women are still underrepresented in these STEM fields (science, technology, engineering, mathematics, etc), and this gives rise to problems regarding economic and social discriminations, as there is a rising importance of STEM occupations. Research suggests that the proportion of female STEM teachers has a quite powerful effect on

female students and their decisions to declare (and graduate with) a STEM degree (Bottia, et al. 2012). It is important to set positive examples as women in science in order to inspire future female students to pursue similar fields.

Background: Archie's Late-Night Party

“Archie’s Late-Night Party” was held on June 8, 2017 at the State Museum, Morrill Hall. This museum sponsored event included several stations, sponsored by different individuals and organizations, that were meant to provide education for the public. Historically, the museum offers hands-on activities that allow for the exploration of various science topics from technology to biology. Families were able to interact with a diverse science community and provide their children with the opportunity to learn. The event accommodated approximately 500 community members, and the primary focus was on children aged five to ten. Dr. Bachman was asked to design and present two stations, in which she enlisted my help. These stations were required to be both scientifically accurate and kid friendly. The first station covered hibernation and sleep, and the second station covered the basics of vision and nocturnal vision.

METHODS

To begin the planning process, the topics to cover were outlined. The components of each station were determined. It was decided that the first station, “Sleep and Hibernation”, would include information about how and why animals sleep, along with general facts and the process of hibernation. The second station, “Nocturnal Vision”, was determined to explain the basic processes of both normal vision and nocturnal vision.

Following the outlining process, research was conducted through scientific literature. Facts were obtained through journals found on “Google Scholar”, and they were noted in a document. Enough facts were obtained to fully understand the science behind each topic. The information was then compiled to be more specific and presented in a way that children would be able to understand.

The online source, Pinterest, was utilized for the research of creative and kid friendly design ideas. The design ideas for poster layouts, the life-sized hibernation dens, and table decorations were found using this source. Two hibernation dens were to be made to represent the hibernation conditions of squirrels and bears, and they were to be large enough for the children to crawl in and interact with the exhibit.

Posters were then created to communicate the information in an effective way. The posters were designed using PowerPoint. A first draft was created, edits were made, and the posters were sent to be printed. Titles were large, and the information was organized in an easy to read manner. The presented facts were scientifically accurate, yet concise, as to not overcrowd the poster. Each poster had one topic, and they were color coded per station. Bright colors and representative photographs were used as well to capture the interest of both parents and children.

Once the posters were created and the curriculum was planned out, interactive activities were created to engage the children and their families in the information. Pinterest was utilized as a source for ideas in this step as well. Stamps, stamp pads, and colorful notecards were ordered. Stamp designs included squirrels, bears, turtles, and bats. A sheep brain and multiple cow eyeballs were ordered (Carolina Biological Supply) to be dissected and displayed. It was planned that Dr. Bachman's turtles would be present at the event and hibernation in these animals would be discussed.

The final preparation step was to craft. A week prior to the event, Dr. Bachman, her lab assistants, and I came together to put together the crafts under my direction. The bear and squirrel hibernation dens were created using a refrigerator box and washing machine box, respectively (Figure 1). The boxes were covered with crumpled up brown paper, and leaves and sticks were hot glued on. The banner to hang by nocturnal vision station was also created by hot gluing sticks, glow in the dark stars, a cloth "moon" and googly eyes onto a large black sheet of paper (Figure 9).

The day of the event, materials and supplies were moved to the museum with the help of Dr. Bachman's lab assistants. The sheep brain and cow eyes were dissected. Sticks and leaves were placed in the squirrel den, along with peanuts, a roll of toilet paper (the poster with this display noted that squirrels store nuts to eat and they urinate during hibernation), and two toy squirrels. A sign was also made to place on the squirrel den that indicated peanuts were within that den in case any children were allergic to them. A large stuffed toy black bear was placed into the bear den (Figure 14). Dr. Bachman's turtles were also transported to the event. The displays were then set up in a strategic manner, allowing observers to move through the stations, observe the information, and participate in activities easily.

RESULTS

Summary: Sleep & Hibernation Science, Background Information

The information below is written in a manner to avoid scientific jargon and represents my 'kid friendly' working notes. In lieu of citations for each fact or topic, I will provide a list of the references used for each paragraph.

Animals need sleep because the process gives your brain cells time to grow, store energy, and undergo the changes known as learning. The brains of most vertebrates have cells that act like a clock to inform you when you are in need of a recharge, and these cells run on a 24-hour cycle and are in the suprachiasmatic nucleus in the brain. The pattern of 24-hour activity is called the circadian cycle. Sleep is possible because a regional of the brain, known as the reticular formation, slows down information coming (which explains why you are less aware of sound at night). Some animals only allow one half of their brains to sleep at a time, and the other half is still awake. Nocturnal animals, including bats, have circadian clocks that allow them to be awake at night and sleep during the daytime. (References: Mistlberger, 2005; Lesku, et al. 2006)

To survive the winter months, animals may go into a sleep-like state. Winter is not only cold, but there is also a reduced food supply. Hibernation allows some animals to escape the high metabolic rate that would be needed to stay warm over winter, and it reduces the need for food to fuel this high metabolic rate. In short, hibernation allows animals to escape the metabolic demands of winter. Hibernation is not sleep. It is a state that is not only different in duration, but it is also different in means of metabolism, heart rate, body temperature and excretion. A hibernating animal's body temperature can drop as much as 63°F, to nearly freezing. The word 'hibernation' literally means, "to pass the winter" and involves being in a sleep-like state with brief bouts of wakefulness. Animals hibernate in many different ways. Birds, for example, do not

need to hibernate, as they can simply fly to a warmer place. Bears eat all year long in order to store up body fat as an energy source during hibernation. They do not eat or use the restroom while they hibernate. Smaller animals are more likely to hibernate because migration would require a very large amount of energy relative to their small body size. Squirrels find and store nuts throughout the year so that they can eat them while they hibernate. They also use the bathroom(urinate) and make a comfortable and safe bed to sleep in. Box turtles are cold blooded and are not able to control their own body temperature, so they hibernate in order to keep from freezing. The technical name for this process is brumation. (References: Carey, et al. 2003; Geiser, 2004; Hellgren, 1998; Buck & Barnes, 1999; Metcalf, 1979)

Summary: Nocturnal Vision Science, Background Information

In normal vision, light is transmitted in little pieces, called photons, that hit photoreceptors on a surface on the back of the eye called the retina. There are two types of photoreceptors that receive the photons. Rods are rod shaped and help us to see in low light situations. Cones are conical at one end and help us to see color. (Silverthorn, 2016).

There are numerous animals that have the ability to see at night, called nocturnal vision. These animals include, but are not limited to, badgers, bats, skunks, and hedgehogs. The main feature of the eye that is responsible for nocturnal vision is the tapetum lucidum. It is located anterior to the retina in the back of the eye, and it helps animals see better in low light. It reflects the small number of photons that come through right onto the photoreceptors. The reflection created from this process can make animals' eyes look like they are glowing, and this is called eyeshine. (References: Warrant, 2007; Ollivier, 2004)

Pinterest Search

Pinterest searches gave rise to the idea of creating “life sized” hibernation dens for squirrels and bears that children could interact with (Figure 1). It also provided the idea of having a special, decorated banner in front of the nocturnal vision station to attract the attention of the attendees (Figure 9).

Event Display



Figure 1: The hibernation den (right) and the squirrel hibernation nest (left). These were approximately 2 ft x 3 ft, and children could enter and interact with the stuffed animals inside. I placed these next to each other so the kids could see that the bear had nothing in the den, but the squirrel had leaves and nuts, illustrating how hibernation differs.

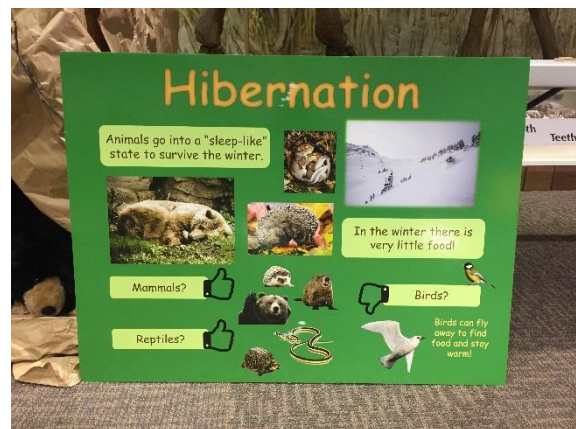


Figure 2: The poster describing hibernation. Note that the information that is on the paper is much abbreviated from the ‘background’ information I collected. This illustrates the process of gradually paring back information presented in the poster. I also used ‘up’ and ‘down’ thumbs to illustrate who hibernates, using pictures were possible.

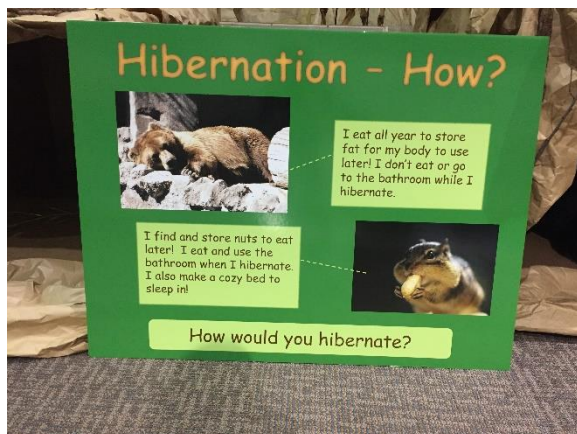


Figure 3: The poster describing different types of hibernation. This poster illustrates the different ways hibernation can occur, specifically between squirrels and bears. Note the “quote bubbles” used to make it seem as if the photos of the animals are speaking to the audience. I used this poster as an introduction to the hibernation den activity.



Figure 4: The poster explaining Box Turtle hibernation. This poster explains why Box Turtles (and other reptiles) hibernate. I used the “quote bubble” coming out of the photo of the turtle on this poster as well. There were real Box Turtles next to this poster for audience members to view.

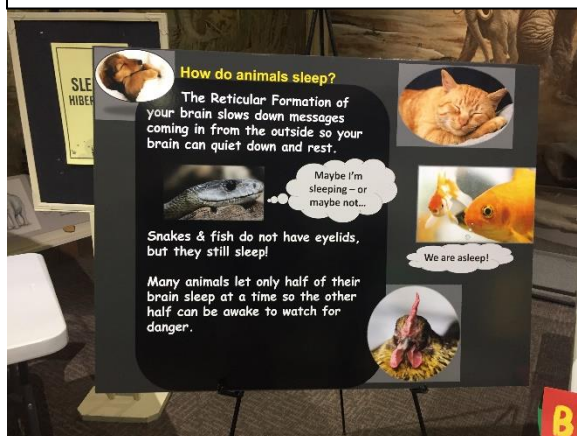


Figure 5: The poster describing how animals sleep. The “quote bubble” technique was used again. Note the various pictures of animals, indicating that all animals need some form of sleep to live. This poster gives different mechanisms in which different types of animals sleep.

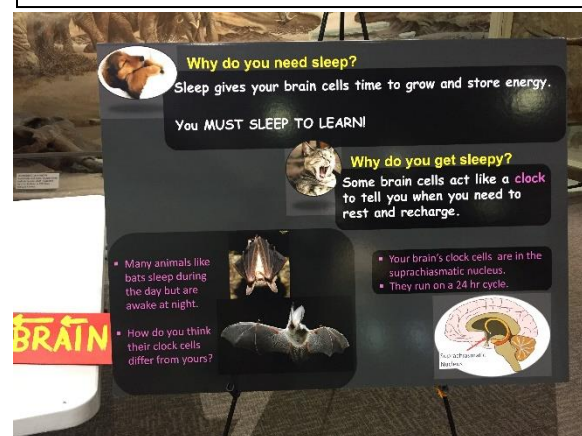


Figure 6: The poster discussing the importance of sleep. This poster addresses the fact that sleep is necessary for learning and the brain’s clock cells that are necessary for sleeping rhythms. A picture of a brain is used to show the area within that controls the sleep cycle. Also note that the sleep of nocturnal animals, specifically bats, is addressed.

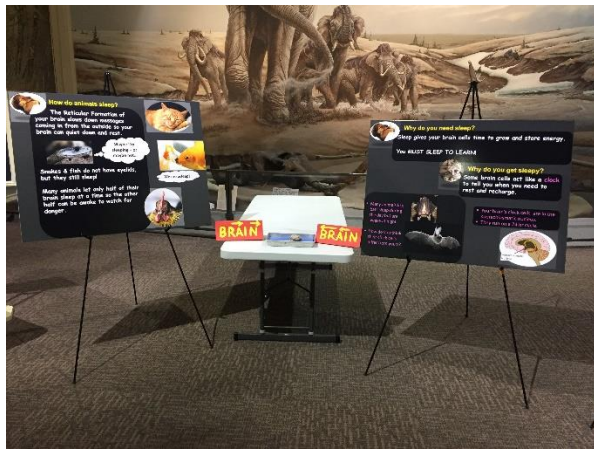


Figure 7: The sleep station. This station includes both posters with information pertaining to sleep, as well as a sheep brain. Note that it is an intact, undissected brain. The purpose of the brain was to give audience members an accurate representation of a real brain, and for them to think of the clock cells within the brain.

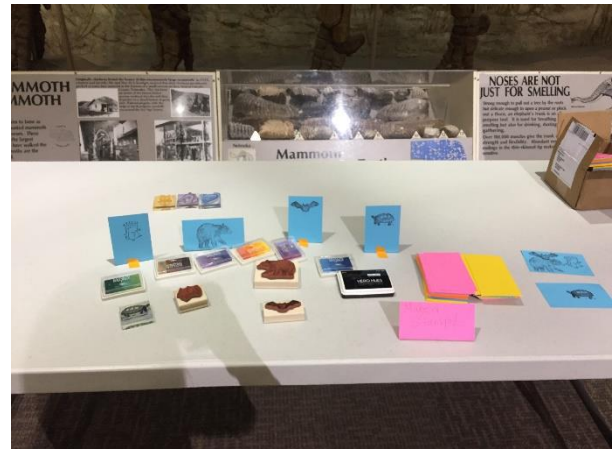


Figure 8: The stamp activity station. There were multiple different colors of note cards for children to choose from, in which they could place their stamps on. Stamp types included a bat, bear, sleeping squirrel, lizard, and turtle. There were also several different colors of stamp pads. Children were able to create a stamped note card to take home as a souvenir.



Figure 9: The Nocturnal Vision station. This station included two posters: one discussing normal vision, and the other discussing nocturnal vision. The table was decorated to represent night time. There was an eye model (near the 'Normal Vision' poster) present to demonstrate the structure of a human eye. Cow eyeballs were dissected and presented to display the tapetum lucidum and other parts of the eyes.

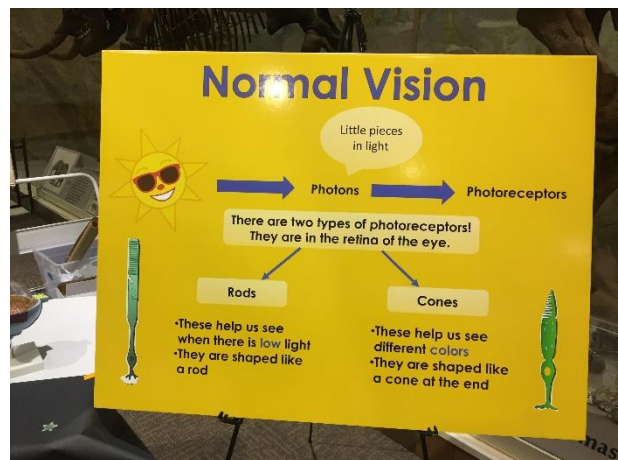


Figure 10: The poster describing the basics of normal vision. A flowchart was used to show the passage of light from the sun to the photoreceptors. A picture of a sun was used to make the poster more eye appealing. Illustrations of the rods and cones were used to allow the visualization of the different photoreceptors.

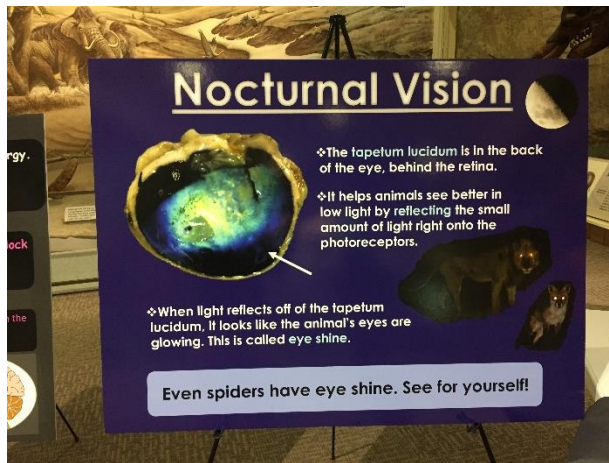


Figure 11: The poster explaining nocturnal vision. A moon is in the top right corner of the poster to represent that it is night time. Photos of a lion and fox with eyeshine are also shown to illustrate how the tapetum lucidum reflects light. The largest photo is the tapetum lucidum, which represents the key added element in the eye of a nocturnal animal.



Figure 12: Interaction at the Nocturnal Vision station. A mother and her daughter spoke with me about the different parts of the human eye, and how human eyes compare with the dissected cow eyes. The girl also read the 'Normal Vision' and "Nocturnal Vision' posters out loud to her mother.



Figure 13: Interaction at the Nocturnal Vision Station. I spoke with a family about nocturnal vision and how the tapetum lucidum allows for that to happen. The young boy (and his father) was intrigued by the slimy eye ball, and it was evident that he greatly enjoyed touching it.



Figure 14: The stuffed toy squirrels and bears. The two stuffed toy squirrels were placed in the squirrel hibernation nest, and the large stuffed toy bear was placed in the bear hibernation den. These stuffed animals were put in the dens to create a clearer picture of what specific hibernation dens would look like. They also served as toys for the children to play with.

Survey

Statement	Average Rating
This station provided information that children could understand.	4.7
This station was eye-catching and attractive to children.	4.6
This station had age appropriate activities or displays.	4.7
This station's overall quality was...	4.9

Table 1. Rating system: 1 – Very poor, 2 – Poor, 3 – Average, 4 – Good, 5 – Very Good

The surveys were generally positive, with a rating of 4.9 out of 5 for overall quality. This represents that the average rating was very close to the “Very Good” category. There were no negative responses, and comments were generally positive. The reactions I observed of both children and parents matched the survey results.

DISCUSSION

Building a Display

The initial research portion was not difficult. I had previous knowledge of each of the topics, and the further research served the purpose of deepening my understanding of the topics. The deeper understanding was crucial in order to be able to effectively convey the information to the event attendees. A crucial aspect in understanding science is research experience. It allows one the ability to effectively communicate many fundamental things, including evidence evaluation, drawing conclusions, and communicating practical and valid arguments (Laursen, et al. 2007). The deep understanding I had of the information I presented proved to be successful at the event when I was able to effectively communicate with the attendees.

When creating the posters, I tried to keep them simple, with many pictures and few words. This was difficult to do because there is a significant amount of science behind the topics. I outlined the topics and provided necessary facts to generally understand each topic (Figures 2-6, and 10-11). I think the color scheme was very effective as well. The posters were eye catching, but not too busy. Attention was focused to the facts and the associated pictures.

The interactive activities were the most effective in drawing in the attention and interests of the children. They were designed to allow hands on interaction. The hibernation dens were built with the intention that the children would crawl into them and imagine what it would be like to hibernate like a squirrel and a bear (Figure 1). The stamping activity station was intended to provide a “craft” that the children could take home with them to remember the event (Figure 8). The sheep brain and dissected cow eyes were there to serve the purpose of adding an extra prop to look at, which hopefully helped the attendees connect more dots to remember the information better (Figures 7 and 9).

Challenges

Simplifying and presenting the facts in a concise manner was no simple task. For example, one can easily compare hibernation to sleep. But, hibernation and sleep are quite different states – they differ in duration, metabolism, excretion, etc. I was challenged to explain things in ways that children could understand, while providing them with one hundred percent accurate information, but also not overwhelming them with information as to lose their interest. This proved to be a personal challenge because I was struggling to force myself to imagine what would catch a child’s eye. One difficulty in conveying information is selecting the correct terminology, as it should not be too codified nor too simple (Johnson, et al. 2014). While the

information should not require a previously advanced understanding, it should still provide a small learning challenge and a memory to help solidify the information in their brain.

When researching, I originally took very in-depth notes about each topic to the point where I had a full understanding of everything. A general rule when creating posters, especially for kids, is that there should not be too many words, and it should be easy to follow. For example, the “Hibernation – Turtles” poster (Figure 4) was the simplest, stating that box turtles are cold blooded and that they hibernate to keep from freezing, with a picture of a turtle, of course. I used a “quote bubble” coming from the turtle’s mouth to make it seem as if the turtle was telling the children the fact that it needs to hibernate. I used this same strategy on the “Hibernation – How?” poster (Figure 3) by quoting both a squirrel and a bear. I think that using the quotes coming from the animals personalized the information and brought it down one more level so the children could understand it. I also think that it puts a picture to the words they read, helping to solidify it in their mind. In the “Hibernation” poster (Figure 2), I utilized thumbs up and thumbs down to inform the children which animals hibernate, and which do not. I used the thumbs up/thumbs down approach because I feel that those hand signals are universally understood, and I observed many children giving thumbs up/thumbs down to the posters when they would see the different animals. This was important as it indicated that the kids were paying attention to the poster, and they were actively engaged with the material, as I had hoped.

For the “Normal Vision” poster (Figure 10), I used arrows to direct children’s attention from one side of the poster to another. The picture of the sun had an arrow to photons which had an arrow to photoreceptors. I then explained very briefly the meaning of photons and photoreceptors, and the different types. Once again, there were pictures corresponding to the information to help solidify it in a different way. In the “Nocturnal Vision” poster (Figure 11) I

took more of a “basic” approach. I tried to color the poster (and add a moon) to signify night time, and I kept the words minimal, with the few very important words being colored differently to stick out.

While the process of creating the posters and portraying the information in a simple, scientifically accurate, and intellectually challenging way was no small task, I believe I completed it well. This was the process that I had to put the most work into, although it may not seem so. There are seven styles of learning: visual, auditory, verbal, kinesthetic, logical, interpersonal, and intrapersonal (Pinantoan, 2012). The posters provided the information in visual, auditory (hearing others read out loud), and verbal (reading out loud themselves) ways. Interpersonal learning occurred because it was in a group setting. The kinesthetic learning style was available as well, as there were objects (eyes, brains, models, turtles, hibernation dens) to touch and interact with at each station. Finally, the logical learning style was used primarily at the vision station, as the “Normal Vision” poster (Figure 10) used a flow chart, representing a more mathematical approach. Although the process was very challenging, information and activities were presented in a way that six of the seven learning styles were incorporated. This allowed for children to learn, regardless of their specific learning styles.

Experience with Children

Overall, I was impressed by the response the children had to the stations. In almost every child that walked through, I saw an excitement to learn. Responses ranged from, “Mom, look at me! I’m a bear!” to “Can I touch it?” The children’s interactions with the activities and information were great.

The hands-on activities also heightened their interests. At the nocturnal vision station, multiple cow eyes were dissected that participants were able to examine and touch (Figure9). Likewise, at the Sleep station, there was a sheep brain to display the regions of the brain that take part in sleep (Figure7). The opportunity to touch real brains and eyes was intriguing to the observers. While many adults found the brain and eyes to be “gross”, the children could not touch them enough. It was interesting to observe the reaction to touching both with and without the science. Having an object in which children can say, “Look! Cool!” is especially helpful in focusing attention and creating an excitement for the topic.

Dr. Bachman’s turtles were a useful visual aid as well. Many of the children had never been able to see a turtle up close before, and they were fascinated. Dr. Bachman’s graduate student, Ben, did an exemplary job of sharing turtle facts with the children. His upbeat personality and passion for the turtles drew the children’s attention in even more. This is evidence that it is beneficial when someone with a passion for the topic shares the information to others.

Dr. Bachman and I did not have the initial intention for people to touch the brain or eyes. For some reason, touching the slimy objects was a big deal and we did allow them to do so (Figures 12 and 13). It can have a big effect on learning when children utilize their bodies (Schwartz, 2015). I am convinced that the children (and adults) touched the slimy objects in out of curiosity. To them, it is an opportunity most people may not have, as it is not common to be able to go up and grab a brain or eyeball. Children have a natural tendency to touch basically everything in sight, and it was no different at the event. Touching something is part of the kinesthetic learning style, and it helps to make more connections in the brain in order to store the

information. It is well known that the more ways you process information, the more likely you are to remember it. Hand sanitizer was available!

In general, I was surprised that the audience took the sheep brain and cow eye displays somewhere where I did not intend. This tells me that I did not fully think through the impact these stations would have. However, I do not think this is a bad thing, and I see it more as a learning experience. I am glad that the audience had the interest and imagination to take the display even farther than I had planned, and it shows me that there was advanced interaction with the display.

The biggest hits were the seemingly senseless activities. While crawling in a cardboard box and stamping a notecard may not sound trivial, the children loved it. The stamp station was overwhelmed with excitement as they were able to stamp bears, bats, squirrels, and lizards onto a card of their favorite color to take home with them (Figure 8). Parents also took this opportunity to help their children with dexterity skills as they placed the stamps on the cards. For a specific example, I observed multiple parents help their children with the stamping process by guiding their hands from placing the stamp on the stamp pad to carefully pressing the stamp down on the poster card. Multiple children would then look up with their parents in great excitement because they completed a perfect stamp. The stamps were intended as a reminder of the event so their ability to contribute to dexterity learning was another unintended learning moment provided by my displays.

The children seemed to enjoy the squirrel and bear dens the most (Figure 1). Something as simple as two cardboard boxes provided an activity that occupied the children for a great amount of time. They would crawl in and out of the “dens”, pretending to be a squirrel or bear themselves. I think the added features within the dens provided science to the children without

having to tell them. For example, there was a roll of toilet paper and a bag of peanuts in the squirrel den, which is a clue to the children that squirrels eat and use the bathroom when they hibernate. I also think the stuffed animals placed in the dens created a sense of reality for the children as they explored the caves. I think they were able to imagine what a real hibernation den would look like, and their interactions with the activity very clearly showed this. From “Look, Dad! I am a squirrel!” to “Grrrrrrr I’m a hibernating bear. Don’t wake me up!” the children showed their excitement for the topic. Some curled up in a ball to pretend to hibernate, and others walked around on all fours.

I observed a lot of positive interactions between the adults and children. Many parents took photographs of their children with/in the hibernation dens and turtles. These are useful experiences because there is now a memory of the event, and the learning associated. Parents can re-visit the photos in the future with the children and discuss all of the fun they had, as well as all of the cool information they learned that evening. The posters also allowed the chance for parents to interact with their children. Some parents read the posters aloud to their children, and others had their children read out loud to them. Regardless of the method, the reading of the posters was often used as a discussion point. I observed multiple times parents asking the children what they think of the information and discussing it further. While I think the children learned an immense amount of information, I also think the parents were exposed to new information as well.

There was great benefit to having a breadth of opportunities for the children to interact with. No child learns the same, and I did not expect (nor am I surprised) that everyone did not do the same thing. Each child participated in the activities that they were intrigued by, and each did so in different ways. For example, some children climbed in and out of the hibernation dens,

while others just wanted to snuggle with the stuffed animal. Overall, the wide variety of opportunities allowed for maximal learning amongst the audience.

Positive Surveys

The positive reactions from the surveys confirmed that I presented the information on the right level. The generally positive comments left on the surveys mentioned the fun interactive activities and the large amount of information the children learned. Overall, the reactions I observed from parents and guardians seemed to closely match the survey results. Dr. Bachman and I received multiple comments praising the event, and both parents and children seemed to be having a positive experience.

Career Building

Science outreach is also beneficial for science professionals that will be working with community members. It is a great resource to practice these types of communication. In a way, the field of dentistry involves communicating science to a non-scientist. My ultimate goal is to become a general dentist serving a rural community. This experience opened my eyes to the difficulties of communicating science to a non-science audience, and it provided me with the opportunity to learn new skills in this field that I will be able to use in the future.

Process Reflection

Regarding my personal development, I think this experience strengthened my confidence as a leader and my ability to take charge and make decisions. Dr. Bachman allowed me to make virtually every decision and gave me only minor suggestions throughout the process. I was the leader, and the success of the event greatly increased my confidence in my leading abilities.

My academic development was affected in a way that I did not expect. I have a strong background in biology, as I am a biochemistry major, so I had previous knowledge of each of the topics being covered at the event. There were few new things that I learned while developing the posters. What I did learn was simplicity, and from that I gained a deeper understanding of the topics. Simplifying facts to a child-level while remaining scientifically accurate seemed as if it would be an easy task – but it was not. This process led to a much deeper understanding of each of the topics on my part. In fact, I actually had a question in the biology section of my Dental Admissions Test that I took shortly after the event.

This experience greatly contributed to my professional development. As a hopeful future dentist, people skills are extremely important. It is my goal to provide a family friendly environment in which kids feel comfortable as well. It helped me to strengthen my communication skills with families, which will be my primary patient pool in the future.

Science Outreach Benefits

The stations that I organized were only two of many stations that evening. Attendees had the opportunity to learn an incredible amount of information at the event. I think this is a huge benefit for society. Children who have the opportunity to learn such things at a young age have a head start in an academic future. I believe this event and ones like it are a great way to increase the desire to learn in kids and to help them to realize how fun learning can be. The public outreach portion of grant writing is extremely important, and it is a great way to use great minds to inspire future generations.

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